

SYNOPSIS OF THE RIFFLE BEETLE GENUS *ZAITZEVIA* (COLEOPTERA: ELMIDAE) IN NORTH AMERICA, WITH DESCRIPTION OF A NEW SUBGENUS AND SPECIES¹

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ABSTRACT: *Zaitzevia* is represented in the Western Hemisphere by a rather variable species, *Z. parvula* which ranges from the Yukon of Canada southward to northernmost Mexico and from the Pacific coast eastward to the Black Hills of South Dakota and the Niobrara River of Nebraska. A new species from the Pacific Northwest, *Z. posthonia*, is sufficiently different from all other known species of *Zaitzevia* to merit erection of a new subgenus, *Suzevia*. The most distinctive feature of *Suzevia* is the form of the penis, which is basally swollen rather than slender and cylindrical.

Aquatic entomologists of eastern North America are familiar with *Macronychus* Muller which differs from all other eastern elmids in having short, 7-jointed antennae. *Macronychus* does not occur west of the Great Plains, but throughout much of that region, from northern Mexico far up into western Canada, a smaller member of the same short-horned tribe, *Zaitzevia* (Champion) is often abundant in foothill and mountain streams.

The genus *Zaitzevia* was created by Champion (1923), who characterized it thus: "Antennae extremely short, with 7 clearly separated joints and a stout elongate club, the latter formed by four fused joints, the sutures between them indistinct or invisible; prothorax with an abbreviated median sulcus and a longitudinal groove on each side of it posteriorly; elytra simply punctate-striate, the fifth interstice sometimes costate; body narrow, elongate, resembling that of *Esolus* in general facies; the other characters as in *Grouvellinus* (= *Microdes* Motsch.)."

When created, the genus included only the type-species *Z. solidicornis* and a second species *Z. acutangula*, both taken from the Himalayan foothills of northern India and described along with the genus. Since then, a number of species have been described from Japan and southeast Asia, but some of these have subsequently been split off into new genera such as *Paramacronychus* Nomura 1958, *Zaitzeviaria* Nomura 1961, and *Urumaelmis* Sato 1965. Ironically, the only feature now separating the genus *Zaitzevia* from these "daughter" genera was not even mentioned by Champion in his description of either the genus or the type-species: the elytra of *Zaitzevia* have granulate carinae on striae intervals 5, 7, and 8, but none on other intervals. A total of 18 species are presently known from Asia (Brown 1981).

¹ Received October 23, 2000. Accepted December 10, 2000.

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In the Western Hemisphere, 3 species have been described which are assignable to *Zaitzevia*: (1) *Macronychus parvulus* Horn 1870, from Fort Tejon, California (south central Kern Co.), (2) *Elmis columbiensis* Angell 1892, from the Fraser River Valley of British Columbia, and (3) *Macronychus thermae* Hatch 1938, from a spring with a year-around temperature of ca 22° C, located at the mouth of Bridger Canyon near Bozeman, Gallatin Co., Montana. Hinton (1936) transferred *M. parvulus* to the genus *Zaitzevia*. Angell was obviously not familiar with Horn's species. Sanderson (1938) reported that Angell had apparently designated no type, but that comparison of the holotype of *Z. parvula* with a specimen from the type locality of *E. columbiensis* and determined as that species by Angell convinced him that *E. columbiensis* was a synonym of *Z. parvula*.

It appears from his paper that Hatch (1938), when he described *M. thermae*, was unfamiliar with *Z. parvula* except through Horn's description. The year after *M. thermae* was described, Hinton (1939) transferred it to the genus *Zaitzevia*, stating that it also appeared to be a synonym of *Z. parvula*. As noted from his determination labels, Sanderson in 1946 identified as *Z. parvula* a series of specimens collected by S. A. Forbes in 1891 from the type locality of *M. thermae* and closely resembling the type series of *M. thermae*. Surprisingly, however, Sanderson (1954, p. 11) listed *Z. columbiensis*, *Z. parvula*, and *Z. thermae* as presumably valid species, without comment and without citing his 1938 paper. Leech and Chandler (1956) obviously accepted Hinton's synonymy, for they used Hatch's figure of *M. thermae* to illustrate *Zaitzevia parvula* (their Fig. 13-54e). I included both *Z. parvula* and *Z. thermae* in my key (Brown 1972), separating them only on the basis of size and habitat, as gleaned from the literature.

Since 1972, however, I have had the opportunity to examine 13 of the 14 paratypes mentioned by Hatch, looking at the genitalia of two males and a female. The genitalia seem indistinguishable from those of *Z. parvula*. The only significant difference I noted between the two was in the body dimensions, most *Z. thermae* being perceptibly smaller than the average *Z. parvula*. Specimens of *Z. thermae* range from 1.8 to 2.2 mm in length and 0.7 to 0.8 mm in width, *Z. parvula* from 1.9 to 2.6 mm in length and 0.7 to 1.0 in width. The difference in width is related to the fact that in all specimens of *Z. thermae* the wings are reduced, whereas many or perhaps most specimens of *Z. parvula* have normal wings. Furthermore, I might point out that the features in which *Z. thermae* differs from *Z. parvula* are the same as those by which other elmids, such as *Microcyloepus*, inhabiting thermal springs differ from typical or normal members of their species. Unless consistent differences in the genitalia are demonstrable, or molecular or genetic evidence indicates otherwise, I am inclined to consider this facies an ecomorphic thermal syndrome and to question the taxonomic validity of such species. Light might be cast upon the problem by rearing larvae under controlled conditions to determine whether

they might "change species" when reared under different temperatures or other environmental regimes. — experiments more easily suggested than accomplished. For the present, I shall treat *Z. thermae* as a subspecies, *Z. parvula thermae*. It is of interest that this taxon, whether it be *Z. thermae* or *Z. parvula thermae*, is appropriately listed by the U.S. Fish and Wildlife Service in Category C 1 (Candidate Taxon, Ready for Proposal) — as either endangered or threatened.

Adults of *Zaitzevia* from various localities may differ conspicuously in size and coloration. For example, the seven specimens I have from Alberta and Yukon are 2.1-2.4 mm long with piceous pronotum and rufotestaceous elytra and legs, as are the 22 I have from Nevada Co., California. In contrast, all specimens I have from Inyo and neighboring counties of California are 1.9-2.0 mm long with piceous pronotum and elytra and very dark legs. Specimens from other regions differ noticeably from either of these. In some areas, the individuals are far from uniform in appearance, their differences sometimes varying with the season but sometimes being noticeable within a single collection. In view of such diversity, it seems questionable whether we are dealing with but a single species. To investigate the matter, with the help of Susan Meyer Torrans, I examined several thousand specimens from more than 170 localities in the states of Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming, and the Canadian provinces of Alberta, British Columbia, and Yukon. The vast majority of specimens, though widely distributed and rather diverse in appearance, I tentatively consider as representatives of a single species, *Z. parvula*, with genitalia very much like those of all previously described species from Asia. The remaining specimens, from the Pacific Northwest, exhibit a strikingly different form of male genitalia and obviously represent a new species, described below. The genitalia are so different from those of all other known species that I also erect a new subgenus to include this new species.

Zaitzevia Champion 1923, nominate subgenus

Male with penis slender and cylindrical, tapering apically only beyond apices of appressed (and often imperceptible) parameres; last visible abdominal sternum of male about one third as wide at apex as at base (Figs. 7, 9).

Type of subgenus: *Zaitzevia (Zaitzevia) solidicornis* Champion 1923, from northern India.

Suzevia NEW SUBGENUS

Male with penis swollen in basal half, tapering apically from near middle of parameres; last visible abdominal sternum of male about half as wide at apex as at base (Figs. 8, 10).

Type of subgenus: *Zaitzevia (Suzevia) posthonia* NEW SPECIES, from northwestern United States and western Canada.

Etymology: The subgeneric name *Suzevia* is derived from an amalgamation of the name Susan plus the generic name *Zaitzevia*, and is feminine in gender. The new subgenus is named in honor of Susan Meyer Torrans, who

assisted me in examining specimens of *Zaitzevia* from many different localities and who first noted the unusual aedeagus of the new species.

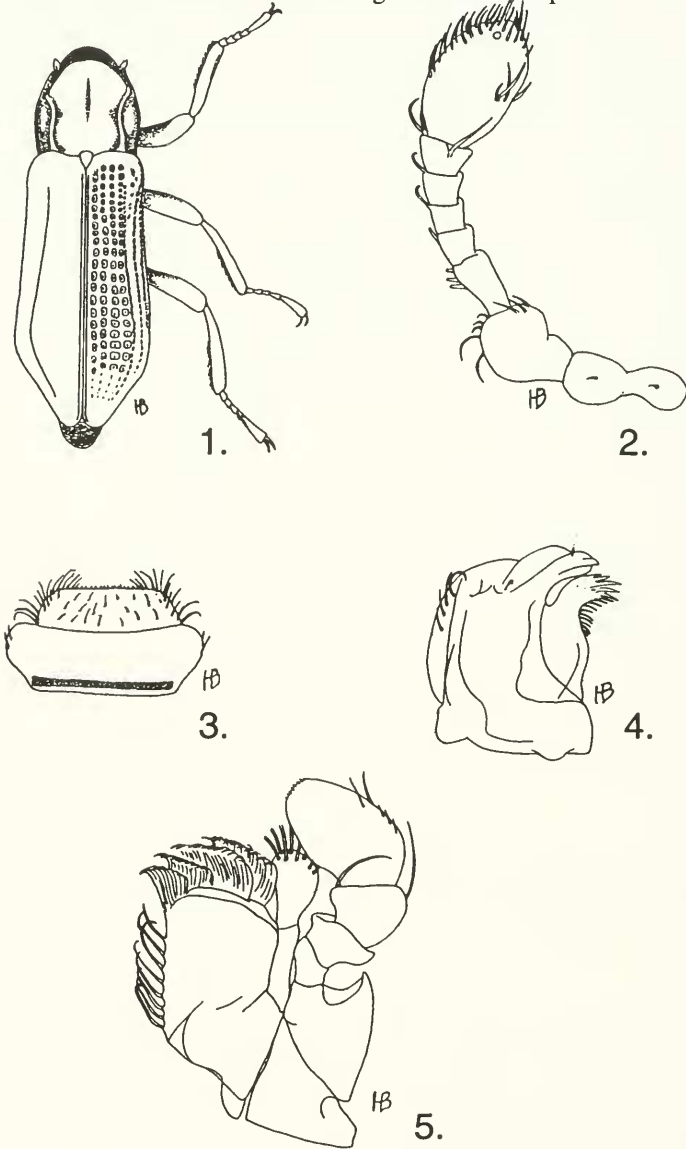


Fig. 1-5. *Zaitzevia (Suzevia) posthonia*, n.sp. 1. Male, dorsal aspect. 2. Antenna. 3. Clypeus and labrum. 4. Mandible. 5. Maxilla.

Zaitzevia (Suzevia) posthonia NEW SPECIES

(Figs. 1-5, 8, 10)

Holotype — Male (Fig. 1). Length, 2.4 mm from anterior margin of pronotum to elytral apex; width 0.9 mm. Body elongate, sides subparallel. Clothed inconspicuously with fine, short, decumbent, testaceous hairs. Cuticle shining, black on head, dark reddish brown on pronotum, testaceous on scutellum, elytra, and legs. Tomentum of elytra from stria interval 5 to margin pale golden

Head covered with silvery tomentum posterior to frontal suture; very feebly impressed along frontal suture. Eyes rather small. Antennae (Fig. 2) testaceous, shorter than width of head capsule, held close to eyes along their anterior and lower margins but with the apical segments directed dorsally or anterodorsally; segment 1 constricted medially, 2 more inflated apically than 1, 3 elongate and subconical, much more slender than 2, 4-7 short and subconical, 8 forming a terminal club with inner border bearing several setae near middle and outer border setose on apical 3/5. Clypeus (Fig. 3) black, with apical angles broadly rounded and apex feebly and broadly emarginate; surface sparsely setose. Labrum (Fig. 3) lighter in color, with apical angles broadly rounded and apical margin straight; surface rather densely setose with pale hairs. Mandible (Fig. 4) as figured, with 3 subacute apical teeth; outer margin with a row of bristles near middle; prosthema entirely membranous and rather densely spinose at apex and on mesial margin in apical half. Maxilla (Fig. 5) with palp 4-segmented; galea much smaller than lacinia, basally rather slender, with apex rounded, knob-like, and bearing a number of spines; lacinia rather broad and flattened, mesial margin bearing a row of spines with recurved tips, and apical margin with 4 overlapping rows of close-set curved setae. Labium with palpigers so well-developed as to make palps appear 4-segmented; terminal segment of each palp slightly longer than broad, with apex rounded subtruncate; apices of palps level with that of ligula; each paraglossa of ligula bearing an apical cluster of about 8 - 12 clavate setae.

Pronotum 0.7 mm long and 0.7 mm wide at broadest point near middle, 0.68 mm wide at base, 0.5 mm at apex. Apical margin as seen from above arcuate at middle, sinuate on each side behind eye before apical angle; apical angles acute but very little produced; sides very feebly sinuate at base, then feebly arcuate to apex; lateral margins feebly crenate; posterior angles subacute, almost rectangular, not produced; basal margin arcuately emarginate on each side and feebly emarginate at middle before scutellum. Median sulcus distinct but shallow, 0.05 mm wide and extending from basal 2/5 to ca apical 1/6. Sublateral carinae extending directly forward from base, then feebly and sinuously first toward midline then toward lateral margin, and ending just beyond middle. With a shallow, opaque (tomentose?) depression along mesial edge of each carina. Lateral borders of pronotum feebly margined. Surface of disk smooth, shining, with shallow punctae separated by several times their own width.

Elytra twice as long as broad (1.8:0.9mm), barely wider than pronotum at base (0.75 mm across humeri), widest at apical 2/5. Elytral apices separately rounded. Lateral and apical margins almost imperceptibly serrate and not at all explanate. Each elytron with 7 apparent longitudinal rows of stria punctures, those on disk being coarse in basal half but becoming finer and virtually obsolete toward apex. There appear to have been 9 striae originally, but 5 and 6 are completely fused, obliterating interval 6, and striae 8 and 9 are almost completely fused. Strial intervals 1-4 (counting the sutural interval as 1) are flat, each bearing a longitudinal row of fine, pale, recumbent hairs. Strial interval 5 bears a low, granular carina composed of ca 35-45 obliquely overlapping scales or elongate granules beginning shortly beyond the base and extending almost to the apex. Similar carinae on intervals 6 and 7 (original intervals 7 and 8) are confluent at base and extend beyond apical declivity. For most of their length, the 3 carinae are parallel to each other, the middle one equidistant from each of the others. Surface of disk smooth, shining, and without tubercles. Sericeous tomentum (plastron) covers the lateral portion of elytron

from interval 5 to margin.

Hind wing rudimentary, nonfunctional (If alate specimens turn up, we may expect that such individuals will also exhibit more prominent elytral humeri and elytral striae and striae intervals not quite as described above, because this is the case with *Z. parvula* and with *Macronychus glabratus*.)

Scutellum flat, 0.15 mm long and 0.12 mm wide, with base and sides arcuate, apex acute; color and texture like elytra.

Prosternum with process 0.22 mm long, shorter than length of prosternum anterior to coxae (0.29 mm), subacute at apex, shallowly excavated medially; surface covered with scaly tomentum except on process.

Mesosternum medially excavated to accommodate prosternal process, very short; length between procoxa and mesocoxa only about 1/8 as long as length of metasternum between mesocoxa and metacoxa.

Metasternum transverse, subrectangular, with shallow median longitudinal sulcus extending from level of hind margins of mesocoxae to posterior border of segment and intersecting a bisinuate transverse groove near posterior margin; depressed medially between both mesocoxae and metacoxae; disk feebly convex; posterior margin flanged and grooved medially to accommodate anterior process of first abdominal sternum; surface rather smooth, without noticeable punctae or granules, sides silvery with sericeous tomentum (plastron).

Abdomen 1.2 mm long, 0.8 mm wide at base and slightly wider at level of segment 2; Sternum 1 with median process campanulate or pentagonal, the anterior angles and apex being rounded, broadly and shallowly depressed, raised lateral borders arising between metacoxae and extending obliquely to posterior margin of sternum. Sternum 2 shorter than 1 but longer than 3, 4 subequal to 3, 5 longest and appearing to be composed of 2 fused segments. Sternum 5, which is the terminal segment, has the apex about half as broad as the widest portion near base, and is broadly truncate with angles broadly rounded and apex very feebly and broadly emarginate. All sterna with surface smooth, without noticeable punctation or granules, covered with silvery tomentum except on median 1/3 or 1/4.

Legs each with conspicuous tomentum on inner margin of tibia; femora of front legs somewhat more robust than those of other legs; tarsi slightly shorter than tibiae, not especially large, with claws not unusually large or hooked; surfaces of legs smooth, not granulate; without noticeable secondary sexual characters.

Genitalia (Fig. 10) as figured, total length 1.28 mm, penis 0.92 mm long, 0.25 - 0.30 mm wide, teardrop-shaped with apex subacute; parameres 0.65 mm long, normally closely appressed to sides of penis, very slender, with apices acute and bearing 4 - 10 erect subapical hairs or spines on inner surface; basal piece 0.47 - 0.51 mm long and 0.20 - 0.25 mm wide; internal sac composed of 2 rather large elongate bladders in basal half of penis which communicate medially with a third chamber that extends to the subapical aperture, apparently without hooks or spines.

Variations. Among 50 pinned specimens taken from a dozen different sites, length from anterior margin of thorax to elytral apex ranged from 2.2 to 2.5 mm, maximum width from 0.81 to 0.92 mm. In a few individuals the pronotum was almost as light in color as the elytra and in a few it was almost black; in many the legs were intermediate in color between pronotum and elytra. The sculpturing of the pronotum varied perceptibly in both depth and extent; in one specimen the median sulcus almost reached the base or posterior margin.

Female. Like male but with apex of abdomen much narrower than that of male and more rounded. In some specimens (e.g., those from near Yakima, WA) the posterior margin of each elytron is apparently perforated near the apex, providing a small circular aperture through which the stylus of the genitalia may protrude.

Types. Holotype male: U.S.A.: Oregon: Union Co., McCoy Creek, Starkey Exp. F., 9/VII/74, Meehan. Deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Also deposited with the holotype and bearing the same data are Allotype female and 2 paratypes of each sex. A total of 20 additional paratypes bearing the same data as the type plus 38 paratypes bearing the following data: OR: Benton Co., Oak Creek 6 mi. NW Corvallis, drift VI/69, Norman H. Anderson, will be deposited in the following collections: The Natural History Museum (London); Canadian National Collection, Ottawa; California Academy of Sciences, San Francisco; Oregon State University, Corvallis; Sam Noble Oklahoma Museum of Natural History (formerly Stovall Museum), Norman; Essig Museum of Entomology at University of California, Berkeley; James Entomological Collection at Washington State University, Pullman; and William D. Shepard Collection, Sacramento.

Other adult specimens examined include the following: from Canada: B.C.: Okanagan Lake, 5/VIII/56, B.F. & J.L. Carr — 1; B.C.: Nine Mile Crk. W of Anarchist Pass on Hwy 3, 7/VII/85, H.P. Brown — 6; from the U.S.A.: CA: Siskiyou Co., Little Shasta River 24/VIII/84, R. Wisseman — 3; CA: Tehama Co., Chico Crk. N Forest Glen, 21/VI/85, H.P. Brown — 1, ID: Benewah Co., SE St. Maries, trib. of St. Joe River beside Hwy 3, 9/VII/85, H.P. Brown — 27; ID: Clearwater Co., Bob's Crk. 5.9 mi ENE Bovill, 3/VI/86, R.S. Zack — 2; ID: Idaho Co., O'Hara Crk., 21/VII.71, S.E. Lowell — 1; OR: Benton Co., Berry Crk., 3/IV/85, N. Anderson — 1; OR: Benton Co., Oak Crk. 14/IV/38, S.G. Jewett, Jr. — 1;

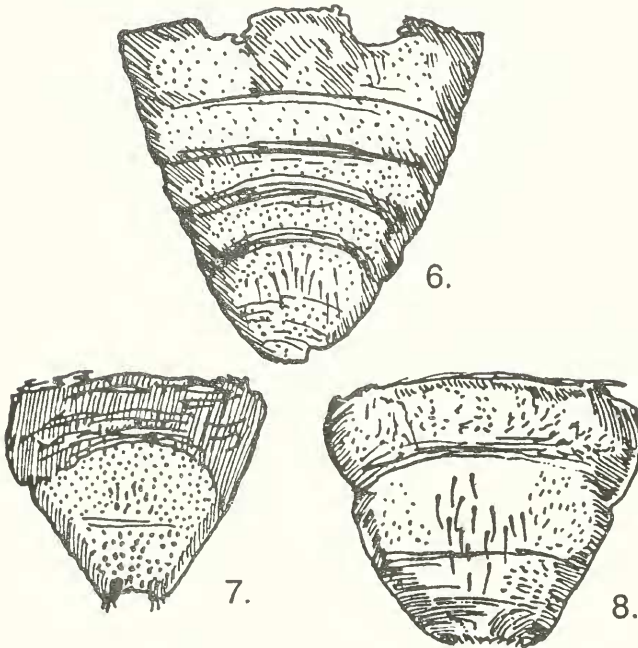
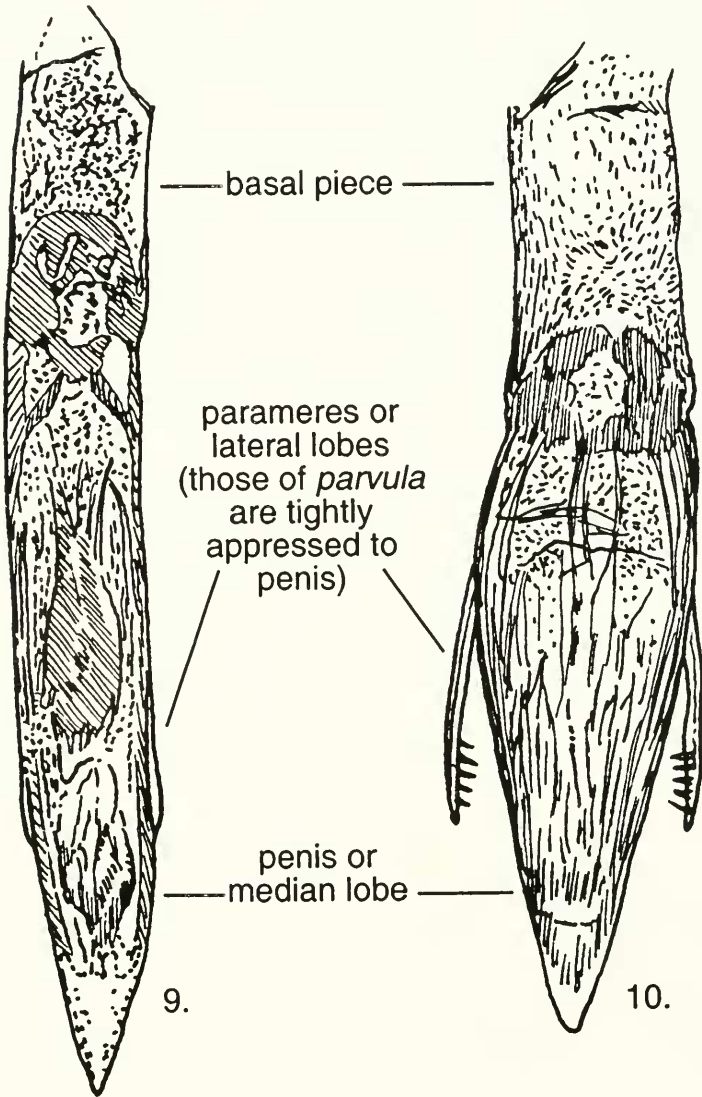


Fig. 6. *Zaitzevia parvula*, ventral aspect of female abdomen. Figs. 7 & 8. Ventral aspect of abdominal sternites 4 and 5 of males: 7, *Z. parvula*; 8, *Z. (Suzevia) posthonia*, n.sp.



Figs. 9 & 10. Male genitalia (aedeagi): 9. *Zaitzevia parvula* 10. *Zaitzevia (Suzevia) posthonia*, n.sp.

OR: Benton Co., Tobe Crk., 4/IX/84, R. Wisseman — 8; OR: Benton Co., Rock Crk. 4 mi SW Philomath, 27/VI/85, P. Spangler — 13; OR: Benton Co., Yew Crk. 24/IV/82, G.W. Courtney — 1; OR: Clatsop Co., Lewis & Clark River, 1/VII/85, H.P. Brown — 18; OR: Columbia Co., Merrill Cr., 17/VII/84, R. Wisseman — 5; OR: Crook Co., Canyon Crk., 30/VII/75, R.A. Miller — 1; OR: Crook Co., Ochoco Crk., 26/VII/74, R.A. Miller — 3; same but 2/X/75, R.A. Miller — 1; and 21/X/76, R.A. Miller — 1; OR: Durkee, 13/VI/47, M.W. Sanderson — 1; OR: Grant Co., EF Canyon Crk., 29/VIII/84, R. Wisseman — 5; OR: Lake Co., Long Cr., 14/ VIII/84, R. Wisseman — 1; OR: Lane Co., Mill Crk. 17/VII/78, T.L. Dudley? — 2; OR: Lincoln Co., Trap Crk. 8 mi. W Eddyville, 25/VI/85, P.J. Spangler — 1; OR: Linn Co., ditch by airfield at Albany, 28/VI/85, P.J. Spangler — 1; OR: Union Co., Meadow Crk., 23/VII/74, Meehan — 1 and 7/VII/75, Meehan — 1; WA: Pacific Co., Middle Fork of Nemah River at Hwy 101, 1/VII/85, H.P. Brown — 37; WA: Whatcom Co., Bell Crk. at Hwy 542 S of Kendall, 4/VII/85, H.P. Brown — 8; WA: Yakima Co., 8 mi SW Tieton RS, Bear Crk., Snoqualmie NF, 11-12/VI/73, D. Corredor — 17.

Etymology. Since the most distinctive feature of this species is the basally swollen penis of the male, it seems quite appropriate that the specific epithet be *posthonia*, derived from the Greek word *posthon* which means "one with a large or broad penis." (See p. 627 of R.W. Brown, 1956.)

Habitat. The new species occurs in gravelly creeks and rivers from lowlands to rather high elevations, typically in clean riffles, often beneath cobbles or boulders. In my limited experience, it has most often been accompanied by such fellow elmids as *Narpus*, *Zaitzevia*, *Optioservus* and *Heterlimnius*, less often by *Cleptelmis*, *Lara*, *Ordobrevia* and *Ampumixis*.

Diagnosis. Within the beetle family Elmidae, this new species will key to the genus *Zaitzevia* Champion 1923 in the adult keys to genera by Sanderson (1953, p. 154), Leech and Chandler (1956, p. 361), Leech and Sanderson (1959, p. 1005), Arnett (1963, p. 476), Hatch (1965, p. 7), and Brown (1972, p. 28). These may be abbreviated in the following key covering known elmids of North America.

1. Antennae with fewer than 9 segments 2
- 1a. Antennae with more than 9 segments all other species of elmids
2. Antennae with 7 segments; pronotum without median impression; on wood in streams east of the Rockies..... *Macronychus glabratus* Say 1825
- 2a. Antennae with 8 segments; pronotum with median longitudinal impression; in gravelly or rocky montane western streams..... 3
3. Male with terminal abdominal sternum as in Fig. 7, simply and rather narrowly biconic at apex; aedeagus as in Fig. 9, slender and cylindrical, with parameres tightly appressed to penis *Zaitzevia parvula* (Horn) 1870
- 3a. Male with terminal abdominal sternum as in Fig. 8, not conspicuously simply and rather broadly rounded at apex; aedeagus as in Fig. 10, relatively robust, with penis swollen basally and parameres relatively conspicuous *Zaitzevia* (*Suzevia*) *posthonia* Brown NEW SPECIES

The terminal abdominal sternum of females of both of the above species is rounded apically as in Fig. 6, so how do I determine the species of a female specimen? Assuming that the males choose mates of their own species, I consider females taken in copulo as belonging to the species of their mates. Fortu-

nately, both *Z. parvula* and members of the new species are frequently taken in copulo. As for the identity of unattached females, I am presently uncertain.

ACKNOWLEDGMENTS

My sincere thanks to Cheryl Barr, University of California, Berkeley, and Bill Shepard, California State University, Sacramento, for their critical reading of this manuscript and their constructive suggestions. The citizens of Birmingham, Alabama appreciate Richard Arrington for his 20 years of service as their mayor, but I add my appreciation for his thorough treatment of such riffle beetles as *Zaitzevia parvula* in his dissertation (Arrington 1966).

The members of the Zoology Department here at the University of Oklahoma are blessed in having the services of Coral McCallister to assist with illustrations, and we bless her.

And genuine thanks are certainly due to those who have provided specimens which I have examined for this study: N.H. Anderson, Oregon State University, Corvallis; M. Brusven, University of Idaho, Moscow; California Academy of Sciences, San Francisco; Canadian National Collection of Insects, Ottawa, Ontario; Carnegie Museum of Natural History, Pittsburgh, Pennsylvania; B.F. and J.L. Carr, Calgary, Alberta; W.H. Clark, Boise, Idaho; S. Frommer, University of California, Riverside; Harvard Museum of Comparative Zoology, Cambridge, Massachusetts; L. LeSage, Biosystematics Research Center, Ottawa, Ontario; R.A. Miller, Corvallis, Oregon; G. Peters, Corvallis, Oregon; M.W. Sanderson, Illinois Natural History Survey, Champaign; P.J. Spangler, National Museum of Natural History, Washington, D.C.; C.M.F. von Hayek, Museum of Natural History, London, England; R. Wisseman, Corvallis, Oregon; R.S. Zack, Washington State University, Pullman.

And special apologies to all whom I provided the names *Suzevia* or *Zaitzevia chandleri* or *Z. milleri*, which are now nomina nuda, the valid name now being *Zaitzevia (Suzevia) posthonia* Brown.

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